Environment Canada Environnement Canada

Municipal Water Rates in Canada, 1986 — Current Practices and Prices

D.M. Tate

SOCIAL SCIENCE SERIES NO. 21

INLAND WATERS DIRECTORATE
WATER PLANNING AND MANAGEMENT BRANCH
OTTAWA, CANADA, 1989

(Disponible en français sur demande)

90-03098/

Published by authority of
the Minister of the Environment

© Minister of Supply and Services Canada 1989

Cat. No. En 36-507/21E

ISBN 0-662-16814-3

Contents

		Page
EXECUTIVE SUMMARY		v
1.	INTRODUCTION	1
	1.1 Purpose and overview	1
	1.2 Methodology	1
	1.2.1 Surveying the municipalities	1
	1.3 Limitations	1
2.	WATER RATE CHARACTERISTICS AND WATER PRICES	2
	2.1 Rate schedule characteristics	2
	2.1.1 Types of rates	3
	2.1.1.1 Flat rates	3
	2.1.1.2 Volume-based rates	3
	2.1.1.3 Frequency of rate schedule usage	3
	2.1.1.4 Unit water prices	4
	2.1.1.5 Summary	6
	2.2 Monthly water prices to consumers	6
	2.2.1 Residential water prices	6
	2.2.2 Commercial water prices	7
	2.2.3 Summary	7
3.	EVALUATION OF CURRENT PRACTICES	7
	3.1 Criteria for evaluating water pricing practices	7
	3.2 Evaluation of current water pricing practices	8
	3.2.1 Cost recovery	8
	3.2.2 Equity	8
	3.2.3 Efficiency	9
	3.2.4 Local acceptability	9
	3.2.5 Summary	9
4.	REFERENCES	9

Tables

1. Size distribution and population of sampled municipalities 2
2. Frequency distribution of combined water and sewage rate schedules, by user group, province and population size group 4
3. Retail water prices (cents per cubic metre) for residential and commercial customers, by province and urban size class 5
4. Residential marginal water price (cents/cubic metre), by province and population size group 5
5. Total price ($) to residential water users for selected volumes of water, by province and population size group 6
6. Total price ($) to commercial water users for selected volumes of water, by province and population size group 7

Illustrations

Figure 1. Total price to residential water users for 10 m^3 per month of water supplied, by province 11

Figure 2. Total price to residential water users for 10 m^3 per month of water supplied, by population size group 12

Figure 3. Total price to residential water users for 35 m^3 per month of water supplied, by province 13

Figure 4. Total price to residential water users for 35 m^3 per month of water supplied, by population size group 14

Figure 5. Total price to commercial water users for 50 m^3 per month of water supplied, by province 15

Figure 6. Total price to commercial water users for 50 m^3 per month of water supplied, by population size group 16

Executive Summary

This report presents an analysis of municipal water rates charged to residential and commercial water users in Canada. The purposes of the paper are to examine the types of water rate schedules in use, to compile both the unit prices (i.e., prices per cubic metre) and the total prices of water paid by consumers across Canada, and to evaluate current practices against some commonly accepted criteria for the operation of municipal water systems. In addition to the information on total prices, as summarized graphically in Figures 1 through 6, other major fundings of the study are as follows.

1. Water rate schedules across Canada are extremely diverse, each municipality having its own unique set of rates. In the 470 municipalities included in this study, over 1100 individual rate schedules were found that pertained to residential and commercial customers, the focus of this study. There were four main types of rate schedules: flat rate, constant unit rate, declining block rate and increasing block rate.

2. The most common type of rate schedule is the flat rate, which may be used alone or form part of a block rate schedule (e.g., a minimum bill with an additional charge based on water use).

3. Almost all rate schedules offer either no financial incentive (i.e., flat rates) or decreasing incentives (i.e., declining block rates) for minimizing water use and the costs of water systems. As a result, over 70% of the rate schedules in current use do not discourage excessive water demand.

4. Mean prices to consumers for 35 cubic metres of water monthly (an average family water use) vary from $7.97 (Newfoundland) to $31.91 (Manitoba), being substantially higher in western Canada than in eastern Canada. (Rates are slightly higher in the Territories, but can likely be attributed to small sample size and unique environmental conditions).

5. Rate-making practices can be assessed against the criteria of cost recovery, equity, economic efficiency and local acceptability. It appears that, currently, acceptability to local ratepayers is the most important factor in rate setting, accounting for the wide variability of rates across the country. Cost recovery and equity considerations are used to varying degrees, but current rates fail to meet any rigorous definition of these criteria. Economic efficiency, which calls basically for achieving water service at minimum cost, appears to be a neglected factor in current rate setting practices.

Municipal Water Rates in Canada 1986 — Current Practices and Prices

1. INTRODUCTION

1.1 PURPOSE AND OVERVIEW

This report presents and analysis of municipal water rates and prices in Canada. More precisely, its purposes are to describe the types of water rate schedules in use, to compile both the unit prices (i.e., prices per cubic metre) and the total prices of water paid by consumers across Canada, and to evaluate current practices against some commonly accepted criteria for the operation of municipal water systems.[1]

Following a brief outline of the methodology used in this project. Section 2 describes in detail the major characteristics of municipal water pricing as currently practiced. Emphasis is placed on (a) the types of overall rate schedules in use, (b) the price per cubic metre paid by customers, and (c) the total monthly price paid by customers for standard volumes of water. (Where billing occurs on a bi-monthly or quarterly basis, prices have been converted to equivalent monthly terms).

Throughout Canada, sewage treatment expenses are normally recovered through surcharges added to the water bill. The term "water pricing practices", as used in this paper, includes the sewage dimension. While the "unit water prices" outlined in the paper are for water supplies only, the monthly water prices include any applicable sewage surcharges. Section 3 assesses the water and sewage rate-making practices used in Canada against the criteria of revenue recovery, equity, efficiency and local acceptability.

1.2 METHODOLOGY

The study is based on a survey of water pricing practices in Canadian municipalities by the Inland Waters Directorate of Environment Canada. A request for copies of 1986 water (and sewage) rate schedules was sent to all municipalities with a population over 5000, plus a 10% sample of those between 1000 and 5000. The usable returns from this letter survey were entered into a database designed to compile both unit water prices (i.e., price per cubic metre) and total water prices to residential and commercial customers for selected volumes of monthly water supply and sewage. Compilations of these unit and total prices form the basis for the discussion of Section 2. Finally, information on criteria for rate setting was derived, principally from the water rates manual of the American Water Works Association (AWWA, 1983). These criteria were used to assess current Canadian water pricing practices.

1.2.1 Surveying the municipalities

The water rate survey produced usable results for 470 of the 800 municipalities surveyed (Table 1). Of the remaining 330 municipalities, 150 did not respond, while an additional 180 had rate scheduled which could not be analyzed systematically because they were unique in some way with respect to their water pricing practices. For example, many of these municipalities based their water charges on assessed property value or frontage.

Since assessed value and frontage data were not collected, water prices for these municipalities could not be calculated, and they were omitted from further consideration. However, these municipalities were all quite small in population terms, permitting the survey to attain a fairly good coverage of Canada's total urban population. About 15.7 million persons, or 78% of Canada's total urban population in 1986 resided in the 470 municipalities considered in the analysis.

1.3 LIMITATIONS

There are several items related to water pricing which were considered to be beyond the scope of this study. First, the analysis is limited to a consideration of residential and commercial water users. Although municipal water rates may also pertain to industry and some rural users (e.g., those residing near but outside municipal boundaries), these users often impose special requirements not considered in this study. Second, the extent to which system costs and other factors influence the setting of water rates has not been examined in any depth. The implication of this point is that the rates collected for this report do not necessarily reflect the true cost of providing water services in many municipalities. Indeed, to the extent to which water rates are viewed as a method of revenue generation, they may include elements not related to water servicing. Third, several provinces charge licence fees for water abstrac-

[1]Throughout this paper, water rates refer to the schedules of charges set by municipalities as the basis for periodic water prices paid by customers for water services (including sewage). In all cases, water prices are converted to monthly amounts, and include combined water and sewerage payments. The subject of more general charges, normally by provinces, for abstraction of water from surface or groundwater sources is not included here.

Table 1. Size Distribution and Population of Sampled Municipalities

	Number of Municipalities					
	1000-4999	5000-9999	10000-49999	50000-99999	>100000	Total
Newfoundland	3	2	4	1		10
Prince Edward Island	3		1			4
Nova Scotia	6	6	6		1	19
New Brunswick	5	5	3	1		14
Quebec	23	25	39	7	1	95
Ontario	40	51	63	13	16	183
Manitoba	5	5	3		1	14
Saskatchewan	6	3	6		2	17
Alberta	8	18	10	3	2	41
British Columbia	13	16	28	9	3	69
Territories	1		2			3
Total	113	131	165	34	26	469
	Population ('000 persons)					
Newfoundland	9	13	83	90		195
Prince Edward Island	2		35			37
Nova Scotia	17	43	88	55	122	325
New Brunswick	13	35	65	81		194
Quebec	73	166	822	477	1105	2643
Ontario	110	357	1387	982	4386	7222
Manitoba	15	36	60	582		693
Saskatchewan	13	19	122		351	505
Alberta	26	109	210	164	1196	1705
British Columbia	33	117	540	599	822	2111
Territories	3		26			29
Total	314	895	3438	2448	8564	15659

tion from water bodies by users, including municipalities. This subject has not been considered. Fourth, the subject of water utility economics is only alluded to, but not explored in depth. The insights into the municipal financing problem offered by economic analysis should be examined at a later date. A major implication of this latter point, combined with the omission of cost factors, is that the comparative analysis provided herein is insufficient, by itself, to define a proper pricing system for municipal water. Finally, many municipalities fund some or all of their water-related expenditures from general revenue. The contribution of general revenue to meeting system costs is not included in the paper.

2. WATER RATE CHARACTERISTICS AND WATER PRICES

2.1 RATE SCHEDULE CHARACTERISTICS

A water utility's rate schedule governs the price that is ultimately charged to individual customers for water services. Throughout Canada, the wide variety of rate schedules in use can be categorized in two basic types — flat and volume-based. This distinction is important in determining the types of incentives or disincentives influencing the water and sewage service demands of customers. Evidence of the inverse relationship between price and water demand has been well documented by Grima (1972), Howe and Linaweaver (1967), and Hanke (1978). Kellow (1970) found that water use in the unmetered, flat rate areas of Calgary was substantially higher than in the metered areas, where prices were based on volumes of water usage. In general, flat rates are associated with higher water use than volume-based rates, because customers pay a fixed price per billing period for unlimited water supplies, and accordingly have no incentive to monitor or control their use (Kindler and Russell, 1984, p. 156). Volume-based charges offer varying incentives for limiting water use, depending upon their particular characteristics, with resultant cost savings.

As already noted, charges related to sewage collection and treatment form an integral part of water prices to customers. Sewage charges take several forms across Canada. The most frequently used form is a fixed percentage of the bill for water supply, but others include flat

rates and, in a relatively few cases, volume-based rates. In the latter case, volumes are measured as water supply, not waste flows, from the customer or establishment.

2.1.1 Types of rates

2.1.1.1 Flat rates

The simplest rate schedule, from both a customer and an administrative viewpoint, is the flat rate, which involves only a fixed levy imposed in each billing period. In return for this levy, the customer is given unlimited access to water and sewage services. Municipalities determine flat rate charges in a variety of ways, taking into account the cost of providing service and, in some cases, expected consumption. Charges may vary among user classes within the same municipality. There are also a number of "indirect" methods in use for water charging, which are equivalent to a flat rate system. For example, additions to the property tax bill, frontage charges or special assessments for water servicing are not normally related to water usage.

The principal disadvantage of flat rate pricing is that it results in higher waters use than volume-based pricing, because the marginal price[2] of an additional volume of water is zero. Customers may take as much water as they choose; this leads to wasteful water use practices such as lawn watering during rain storms or failure to replace dripping faucets or valves. In other words, customers have no incentive to conserve water, and the municipality has minimal control over water demands, except through administrative measures such as lawn-watering restrictions.

2.1.1.2 Volume-based rates

Volume-based rates relate the amount paid for water servicing to the amount of water supplied. Several different methods can be used for establishing this linkage, the simplest being a constant unit rate per unit (e.g., cubic metre) of water used. This type of pricing arrangement is referred to here as a "constant unit rate."

More commonly, however, volume charges vary with the level of water use or among user groups, and are combined with certain fixed charges. These are referred to as block rate schedules, with the most common being the "declining block rate" schedule. Under this type of schedule, water use in each billing period is divided into successive volumes or "blocks", e.g., with use in each ascending block charged at a lower price than in the previous block. Typically, one or two initial blocks cover residential and light commercial water use, with subsequent blocks containing heavy commercial and industrial uses. The lower costs per unit associated with successively higher blocks mean that declining block rates provide a reducing incentive for water conservation because this type of rate has declining marginal costs.

A few municipalities employ conservation-oriented "increasing block rate" schedules, i.e., the prices in successive blocks of the rate schedule increase. In other words, the marginal price of water increases progressively through the blocks of the rate schedules. In these cases, consumers have an incentive to conserve water to avoid the higher rates in the upper blocks. Alternatively, high seasonal rates may be imposed in the summer to curtail seasonal peaking. Large water users and those contributing to peak flows have the largest impact upon water system sizing, so that increasing or even level block rates can significantly lower water demands and system costs.

Within block rate schedules, there may also be price differentiation amongst user groups. In addition to the differentiation among user groups, which is inherent in rate schedules based on volumes of water used, many municipalities have also established parallel declining block rate schedules dealing with the various groups. For example, parallel residential and commercial rate schedules are very common across the country. Customers may also be differentiated geographically, or by jurisdiction in the larger "regional municipalities." Higher rates may apply to more distant customers, but this generally occurs only if jurisdictional boundaries are crossed, since equity concerns within a municipality usually dictate against this practice.

2.1.1.3 Frequency of rate schedule usage

The water rate survey collected just over 1100 residential and commercial rate schedules (Table 2). Many municipalities employ multiple rate schedules (e.g., for metered and unmetered customers), which is the reason that the number of schedules is higher than the number of municipalities in the database. Table 2 categorizes the schedules into flat- and volume-based groups.

Of the 590 residential rate schedules, flat rate charges pertained to just under half (275), and were concentrated in the smaller urban size groups. Flat rate residential charges were employed most frequently in Newfoundland, Quebec and British Columbia. Volume-

[2]The price of an additional unit of water over and above current use is referred to by economists as the "marginal price."

Table 2. Frequency Distribution of Combined Water and Sewage Rate Schedules, by User Group, Province and Population Size Group

	(a) Residential					(b) Commercial				
	Volume-based rates					Volume-based rates				
Province	Flat rate	Constant unit rate	Declining block rate	Increasing block rate	Total number	Flat rate	Constant unit rate	Declining block rate	Increasing block rate	Total number
Newfoundland	10				10	2	4	2		8
Prince Edward Island	4		4		8			4		4
Nova Scotia	12		18		30			18		18
New Brunswick	13	2	6		21	5	2	7		14
Quebec	70	20	6	4	100	33	41	21	4	99
Ontario	99	62	70	2	233	60	65	96	2	223
Manitoba	1	3	11		15		3	6		9
Saskatchewan	1	8	7	2	18	1	5	6	1	13
Alberta	9	24	15	1	49	2	21	14	1	38
British Columbia	54	17	30	2	103	42	21	38	3	104
Territories	2	2			4	2				2
Total	275	138	167	11	591	145	164	212	11	532
Population size group										
1000 – 4999	82	23	37	2	144	50	32	48		130
5000 – 9999	73	43	40	1	157	45	52	52	1	150
10000 – 49999	94	40	69	6	209	38	50	83	8	179
50000 – 99999	18	17	10	2	47	9	18	16	2	45
100000 and over	8	15	11		34	3	12	13		28
Total	275	138	167	11	591	145	164	212	11	532

based rate schedules accounted for the remaining 316 residential charging systems. Declining block rates and constant unit rates accounted for virtually all (97%) of the volume-based rate schedules. Only 11 schedules were of the increasing block rate type. These were centered in Quebec and the Western Provinces and in the 10 000-50 000 urban size group.

Both the flat rate and declining block rate schedules (i.e., about 71% of the residential rate schedules currently in use) are associated with high water use per capita (Hanke, 1978). Much the same pattern emerged for the commercial sector, albeit with a somewhat decreased reliance on flat rates.

The analysis also showed that the first block of rate schedules in many communities can be quite large. In other words, customers in these communities effectively face a flat rate in the range of normal water usage. Accordingly, municipalities having block rate structures may in fact have most of their customers facing flat rate pricing conditions.

2.1.1.4 Unit water prices

Water prices to individual consumers are based on the unit charges built into the rate schedules. Table 3 provides statistics on constant unit prices as well as first and last block prices.

The constant unit prices in Table 3 refer (a) to those schedules where the price of water per unit of usage (e.g., per cubic metre) was held constant, or (b) to schedules having two blocks in which the first block corresponded to a minimum bill. Both of these arrangements have only one nonzero price for water.

As documented in Table 3, retail water prices nationally in 1986 were under 50 cents per cubic metre for both level and block rate systems. Median water prices nationally, as well as provincially, tended to fall below the corresponding means. Thus, in statistical terms, the data were skewed to the left, indicating a bias toward lower rates. The prevailing use of declining block rates was reflected by the consistently higher price of the first block compared to that for the last block.

On a national basis, there was no significant pattern of decreasing prices with increasing community size, suggesting that economies of larger scale operation in water supply, if they do occur, are not translated into lower water prices to consumers. This is likely because provincial governments tend to provide higher subsidies to the smaller communities in the interest of equity. The

Table 3. **Retail Water Prices (cents per cubic metre) for Residential and Commercial Customers, by Province and Urban Size Class**

Province	Constant unit prices				First block prices*				Last block prices†			
			(percentiles)				(percentiles)				(percentiles)	
	Mean	Median	10th	90th	Mean	Median	10th	90th	Mean	Median	10th	90th
Newfoundland	64	50	—	—	34	—	—	—	17	—	—	—
Prince Edward Island	—	—	—	—	30	29	29	32	22	21	21	23
Nova Scotia	—	—	—	—	88	90	21	124	43	33	13	84
New Brunswick	127	160	61	160	110	110	33	202	53	55	2	82
Quebec	24	20	11	49	22	23	11	31	21	15	5	31
Ontario	40	37	17	67	43	35	23	67	24	22	11	42
Manitoba	77	79	62	89	89	80	35	198	58	50	22	165
Saskatchewan	56	64	29	72	54	54	24	75	39	35	8	71
Alberta	56	54	22	91	72	70	25	121	46	46	12	74
British Columbia	19	16	8	35	24	21	13	45	13	10	7	28
Territories	115	68	53	159	—	—	—	—	—	—	—	—
Population size group												
1000 – 4999	39	29	16	72	55	35	17	124	36	23	8	84
5000 – 9999	40	33	11	73	52	42	21	117	28	24	11	55
10000 – 49999	38	31	12	68	42	34	16	72	27	21	8	50
50000 – 99999	29	24	11	66	39	24	14	110	23	17	7	55
100000 and over	47	47	23	68	55	42	13	158	24	22	6	48
Canada	38	31	12	71	48	37	17	100	29	23	8	55

* The first block is defined as the first segment of water use for which a non-zero price is charged. Thus a community with a three-block schedule, for which the first block corresponds to a minimum bill is considered here as having a two-block schedule.

† The last block identifies the remainder or excess water use block corresponding to the last and usually the lowest unit price. Where there are only two blocks, the upper limit of the first block equals the lower limit of the last block.

means for all three rate groups were relatively low, and 10th percentile values very low, compared to the price ranges of most goods and services. Although not shown here, commercial unit prices were slightly higher than residential ones. Finally, New Brunswick had the highest unit water rates in Canada, with the Prairie provinces also having relatively high unit prices. The lowest overall block rates occurred in Quebec and British Columbia. These two provinces also had the lowest constant rates.

The differences among provinces partially reflect variations in the average cost of providing municipal water services. For instance, a number of cost advantages prevail in Newfoundland, Quebec and British Columbia, the provinces with the lowest average rates. These advantages include abundant supplies, frequent availability of gravity-fed systems, and generally good ambient quality. On the other hand, the Prairie provinces incur frequent water shortages and have significant water problems in many areas, which tend to increase the costs of supply. Similarly, in the Territories, climatic conditions cause widespread permafrost, which contributed to high supply costs. The influence of cost conditions may, of course, be offset by available grants given by provincial authorities, thereby reducing capital costs to the consumer and, accordingly, offsetting reve-

Table 4. **Residential Marginal Price* (cents/cubic metre) by Province and Population Size Group**

Province	Marginal price at 35 m^3 per month			
			(percentiles)	
	Mean	Median	10th	90th
Newfoundland	14	11	6	22
Prince Edward Island	15	29	0	32
Nova Scotia	21	20	13	27
New Brunswick	79	61	21	202
Quebec	23	20	11	44
Ontario	37	34	20	44
Manitoba	81	79	35	107
Saskatchewan	54	54	29	72
Alberta	59	55	23	117
British Columbia	23	20	10	40
Territories	57	68	—	—
Population size group				
1000 – 4999	42	29	16	73
5000 – 9999	39	33	16	74
10000 – 49999	37	31	15	67
50000 – 99999	28	24	15	47
100000 and over	40	37	16	68
Canada	38	31	15	68

* Residential marginal price as used here is the extra amount of money customers must pay for water at the 35 m^3 per month level of usage.

nue requirements that would otherwise have to be met through water rates.

Economic theory suggests that consumption of an extra (or marginal) unit of a good or service depends on the price of that unit (Hirschleifer *et al.*, 1960). For this reason, Table 4 was compiled to show the marginal cost of an extra cubic metre of water at the 35 m^3 level of monthly consumption. These prices are below one dollar generally, and nationally below 50 cents. These prices are very low compared to those for most other goods and services, especially when the water prices include transportation costs to the point of use and waste removal.

2.1.1.5 Summary

Water rate schedules across Canada are extremely diverse, with each municipality setting its own unique rates. In the 470 municipalities included in this study, over 1100 individual rate schedules were found that pertained to residential and commercial customers, the focus of this study. There were four main types of rate schedules: flat rate, constant unit rate, declining block rate, and increasing block rate.

The most common rate schedule type is the flat rate, which can be the sole form of charging in use or can form part of a block rate schedule (e.g., a minimum bill with additional charges based on water use).

Almost all rate schedules offer either no financial incentives (i.e., flat rates) or decreasing incentives (i.e., declining block rates) for minimizing water wastage and the costs of water systems. As a result, over 70% of the rate schedules in current use tend to be associated with high urban water demands.

On a national basis, unit prices did not decrease with increasing urban size, suggesting that if economies of large-scale operation do occur, they are not passed on to the customer.

2.2 MONTHLY WATER AND SEWER PRICES TO RETAIL CUSTOMERS

2.2.1 Residential Water Prices

Water prices (including sewer charges) to residential customers vary widely across the country (Table 5 and Figures 1 to 4). The prices for 10 m^3 and 35 m^3 of monthly water supply were used in Table 5. The former represent a minimal monthly water use (e.g., by a one-person residence), while the latter represents the use by an average family residence). The mean residential water price (including sewer surcharges) at the 35 m^3 level was $16.08, reaching lows in Quebec and the coastal areas, with the highest prices occurring in the Prairie provinces and the Territories. Median prices generally fell below the means, indicative of the fact that more rates fell below the provincial averages than above

Table 5. Total Price* ($) to Residential Water Users for Selected Volumes of Water, by Province and Population Size Group

	10 m^3				35 m^3			
			(percentiles)				(percentiles)	
Province	Mean	Median	10th	90th	Mean	Median	10th	90th
Newfoundland	7.97	7.08	5.50	12.00	7.97	7.08	5.50	12.00
Prince Edward Island	11.26	11.42	10.36	12.75	14.93	12.75	11.60	19.34
Nova Scotia	10.06	9.65	5.92	12.72	13.26	12.98	7.04	18.05
New Brunswick	14.87	15.00	5.83	21.72	17.75	17.00	5.83	35.28
Quebec	8.12	4.00	7.50	12.50	9.54	8.48	5.43	15.00
Ontario	11.49	9.13	4.80	20.90	17.39	15.35	7.91	30.00
Manitoba	11.76	10.71	6.53	21.36	31.91	30.39	20.44	38.25
Saskatchewan	12.59	10.92	3.43	18.75	26.26	28.84	10.33	37.59
Alberta	18.04	15.00	8.86	30.00	29.86	29.75	12.72	47.18
British Columbia	8.62	8.00	3.83	13.85	10.09	9.00	4.67	17.31
Territories	19.80	18.29	6.80	31.10	33.19	23.80	19.80	58.04
Population size group								
1000 – 4999	12.96	10.67	5.83	24.74	17.62	12.50	7.08	35.73
5000 – 9999	11.03	10.00	4.80	16.67	16.40	14.00	6.60	26.08
10000 – 49999	10.54	9.30	4.79	17.67	15.82	11.63	6.25	29.75
50000 – 99999	9.41	7.36	3.78	19.53	13.57	10.63	5.67	28.99
100000 and over	8.34	7.30	3.70	13.74	15.91	15.40	5.00	28.99
Canada	10.90	9.25	4.80	19.53	16.08	12.71	6.60	30.00

* Total price includes charges for water and sewage service.

Table 6. Total Price* ($) to Commercial Water Users for Selected Volumes of Water Supplied, by Province and Population Size Group

	10 m^3				35 m^3			
			(percentiles)				(percentiles)	
Province	Mean	Median	10th	90th	Mean	Median	10th	90th
Newfoundland	11.47	1.58	0.62	25.00	14.67	7.92	3.08	25.00
Prince Edward Island	18.20	17.76	17.76	19.52	29.95	29.20	29.20	32.20
Nova Scotia	19.15	16.85	8.43	27.53	23.30	21.07	14.80	30.73
New Brunswick	16.37	14.79	4.44	26.82	24.30	21.00	9.67	36.26
Quebec	8.94	7.08	1.70	17.67	13.54	11.75	5.85	23.12
Ontario	13.73	10.76	5.10	26.11	24.72	21.87	9.50	42.51
Manitoba	16.87	10.74	6.16	37.57	45.92	41.14	20.93	53.13
Saskatchewan	14.73	14.50	8.50	21.96	38.55	40.54	14.50	53.15
Alberta	21.84	20.12	12.71	32.75	45.54	44.12	20.12	65.18
British Columbia	10.31	9.16	4.00	17.30	13.49	11.69	5.67	26.00
Territories	13.30		6.80	19.80	30.25		26.50	34.00
Population size group								
1000 – 4999	15.34	11.91	5.10	31.49	24.17	18.50	8.00	51.90
5000 – 9999	13.60	12.24	4.17	24.33	22.83	19.17	6.50	41.78
10000 – 49999	11.43	9.85	4.60	19.25	21.43	17.83	7.92	42.51
50000 – 99999	12.75	8.75	2.97	28.68	20.51	15.88	7.92	35.00
100000 and over	10.15	7.92	4.40	23.32	25.88	23.81	8.67	53.08
Canada	13.06	10.50	4.42	25.75	26.61	19.08	7.92	42.51

* Total price includes charges for water and sewage service.

them. This reflects findings outlined earlier on the rates themselves. It is interesting to note that New Brunswick, which had the highest unit water prices in Table 4, does not have the highest total water prices to residential consumers. This occurred because New Brunswick has a relatively high number of municipalities on flat rates as compared to the Prairie provinces. These flat rates, which tend to be low, are factored into Table 5, pulling the average residential water price below the averages for the Prairie provinces in teh 35 m^3 range.

2.2.2 Commercial Water Prices

Commercial water prices (Table 6 and Figures 5 and 6) showed the same patterns as those described above, except that commercial rates tended to be somewhat higher. A higher monthly volume was used to represent the larger commercial establishments, since this group tends to use greater amounts of water than the residential user, but comparisons between the two user groups were done on the basis of the same monthly volume of supply.

In terms of the distribution of averages across urban size groups, mean prices tended to decline slightly with increasing size. This may reflect economies of larger scale, although this effect was quite weakly demonstrated in the data.

2.2.3 Summary

Mean prices to consumers for 35 cubic metres of water monthly (an average family water use) vary from $7.97 (Newfoundland) to $31.91 (Manitoba), being substantially higher in western than in eastern Canada. (Rates are slightly higher in the Territories, but this can likely be attributed to small sample size and unique environmental conditions). Commercial water prices tend to be higher than residential prices across the country.

3. EVALUATION OF CURRENT PRACTICES

3.1 CRITERIA FOR EVALUATING WATER PRICING PRACTICES

Current municipal water pricing practices may be evaluated vis-à-vis the objective of promoting effective operation and assuring financial adequacy. A number of criteria can be used for conducting such an evaluation.

The first is cost recovery. According to the water rates manual of the AWWA, municipalities should recover the complete costs of operating, maintaining, up-

grading (where necessary) and expanding their water systems through their water rates. The AWWA, in fact, fixes this objective as one of the two primary functions of water rate design. Accordingly, it was chosen as a criterion in this evaluation.

The second primary objective of effective rate design, according to AWWA, is that of equity, in the sense of sharing the costs of water systems amongst customers in a so-called "fair" manner. This concept, while appearing simple and beneficial, is difficult to define in practice and open to wide misinterpretation amongst bodies that set water rates. This will be discussed briefly below in using the concept of equity as the second evaluation criterion.

A third concept which can serve as a criterion is that of economic efficiency. Without venturing into economic theory, which has been covered effectively by Hirschleifer *et al*. (1960), economic efficiency means achieving a given objective at least cost. This point occurs when the price, in this case of water, equals the cost incurred in supplying the next additional water user. In other words, price should equal marginal cost for a system to be deemed economically efficient. The recent OECD report on water pricing (1987) supports this principle as a condition for effective water management.

A final criterion used here is one of local acceptability. Municipal water rates are established by municipal councils, who must meet the perceived needs of constituents. Local considerations, over and above cost recovery and equiry, may include the aim the remain "competitive" vis-à-vis surrounding municipalities in order to attract industry. This may be why declining block rate systems, commonly referred to as "promotional" rates, are often favoured.

3.2 EVALUATION OF CURRENT WATER PRICING PRACTICES.

3.2.1 Cost Recovery

The FCM report (Federation of Canadian Municipalities, 1985, p. 33) presented evidence that 82% of water supply, 85% of water distribution and 65% of waste treatment costs were currently covered by user charges, normally collected through water rates borne by customers. The remainder was covered through mechanisms such as lot levies, general property taxes, transfers from other levels of government and increased debt. Thus, on the surface, it appears that the user pays for a substantial portion of water system costs.

This view is somewhat contradicted by the current funding "crisis" in municipal water funding, as expressed by various municipal leaders across Canada. This "crisis" suggests that, for some years, users have been shielded from the full costs of maintaining water systems, and, as systems have aged, insufficient means are available fo renewal. As a result, a serious repair and upgrading backlog has occurred and a substantial funding problem has emerged.

3.2.2 Equity

The AWWA used the equity concept as the basis for its recommended water rate setting procedure, which results in declining block rate schedules. The fixed portion of a municipality's total costs (e.g., administrative and billing costs) are incurred regardless of volumes of water used by individual customers or customer classes. Accordingly, these system-wide costs should be borne by all customers. Since all customers face the price conditions of the first or second blocks of the rate schedule, the fixed costs should be recovered in these blocks. Thereafter, the costs of service decline, since only treatment, pumping and sewage expenses are incurred. Accordingly, prices in the upper blocks should be lower than in the initial ones.

Equity is also the principle used in establishing flat rates. Under a flat rate system, all customers in a given category (e.g., residential) are charged equally, regardless of usage levels. It also underlies other practices used in rate setting, such as establishing equal rates across a common juridiction, regardless of the costs of service.

The three interpretations of equity given here (and there are many more) show that this is a difficult concept to define and use objectively. For example, usage of any amount of water for a fixed price and charges based on volume of usage cannot both be equitable. In other words, perceptions of equity vary widely amongst water rate makers.

Furthermore, supposedly equitable situations at first sight may in fact prove inequitable on closer examination. Consider, for example, the case of declining block rates. Under these types of rate schedule, the greater the volume of water used, the less paid per unit of use. For municipal water systems, large users generally dictate the system design capacity, one of the most important (and costly) design parameters for water systems. Large users may have high usage rates or high peaking requirements, or both. Thus, in many cases, a municipality may be forced to have systems larger than required to meet the needs of most users in order to

cater to the needs of a few large users. In these cases, the majority (small users) are actually subsidizing the needs of a few (large users), and an apparent equitable charging system is actually inequitable. The same criticism is even more serious in instances of flat rate charging systems.

The majority of rate schedules observed in section 2 are either flat rates or declining block rates. The other two systems, constant unit rates and increasing block rates, which, for the most part, tend to be more equitable, are used to a lesser extent.

3.2.3 Efficiency

Economic efficiency is a term that refers to achieving given ends at the lowest cost possible. In the water servicing field, efficiency occurs when water prices reflect the cost of providing the extra, or marginal, unit of usage. Further, as shown by Hirschleifer *et al.* (1960), all users, regardless of category, should face this same price. Under such conditions, service occurs at minimum costs, customers are treated equally, system repair and upgrading costs are adequately covered, and system expansions occur only when required by demand conditions. Further, since the customer is accurately informed about the true costs of water services through the water rate, water demands occur efficiently at least cost to society.

Declining block rates imply that marginal costs decrease in progressively higher blocks of the rate schedule. While such conditions may pertain in a static situation, they almost certainly do not through time, as upgrading and expansion costs occur. With flat rates, the implied marginal cost of water is zero. In such a situation, water becomes a "free" good and is subject to overuse and artificially high system costs. Since most municipalities across the country are charged either flat or declining block rate, it seems clear that economic efficiency is not an important consideration in water rate making.

3.2.4 Local Acceptability

Municipal decision-makers must set water rates which are acceptable to their constituents. In many cases, costly decisions are postponed to keep water rates low, and rate schedules are acopted which appear equitable to constituents. This, perhaps, explains best of all the preponderance of flat and declining block rate schedules across Canada, and also the remarkably low cost of water in most communities, as observed in section 2.

3.2.5 Summary

Rate-making practices can be assessed against the criteria of cost recovery, equity, economic efficiency and local acceptability. It appears that, currently, acceptability to local ratepayers is the most important factor in rate setting, accounting for the wide variability of rates across the country. Cost recovery and equity considerations are used to varying degrees, but current rates fail to meet any rigorous definition of these criteria. Economic efficiency, which calls basically for achieving water service at minimum cost, appears to be a neglected factor in current rate setting practices.

4. REFERENCES

1. American Water Works Association. 1983. *Manual of water supply practices, water rates.* Denver, AWWA M1.
2. FCM (Federation of Canadian Municipalities). 1985. *Municipal infrastructure in Canada: physical condition and funding adequacy.* Ottawa.
3. Grima, A.P. 1972. *Residential demand for water: alternative choices for management.* Toronto: University of Toronto Press.
4. Hanke, S.H. 1978. A method for integrating engineering and economic planning. *J. Amer. Water Works Assoc.* 70(9): 487–491.
5. Hirschleifer, J., J.C. de Haven and J.W. Milliman. 1960. *Water supply: economic technology and policy.* Chicago: University of Chicago Press.
6. Howe, C.W. and F.P. Linaweaver, Jr. 1967. The impact of price on residential water demand and its relation to system design and price structure. *Water Resour. Res.* 3(1): 13–32.
7. Kellow, R.L. 1970. *A Study of Water Use In Single Dwelling Residences In The City of Calgary, Alberta.* Edmonton: University of Alberta, Department Economics and Rural Sociology. Unpublished Master's thesis.
8. Kindler, J. and C.S. Russell. 1984. *Modeling water demands.* Toronto: Academic Press.
9. Organization for Economic Cooperation and Development. 1987. *Pricing of Water Services.* Paris.

FIGURE 1

TOTAL PRICE ($) TO RESIDENTIAL WATER USERS FOR 10 CUBIC METRES PER MONTH OF WATER SUPPLIED, BY PROVINCE

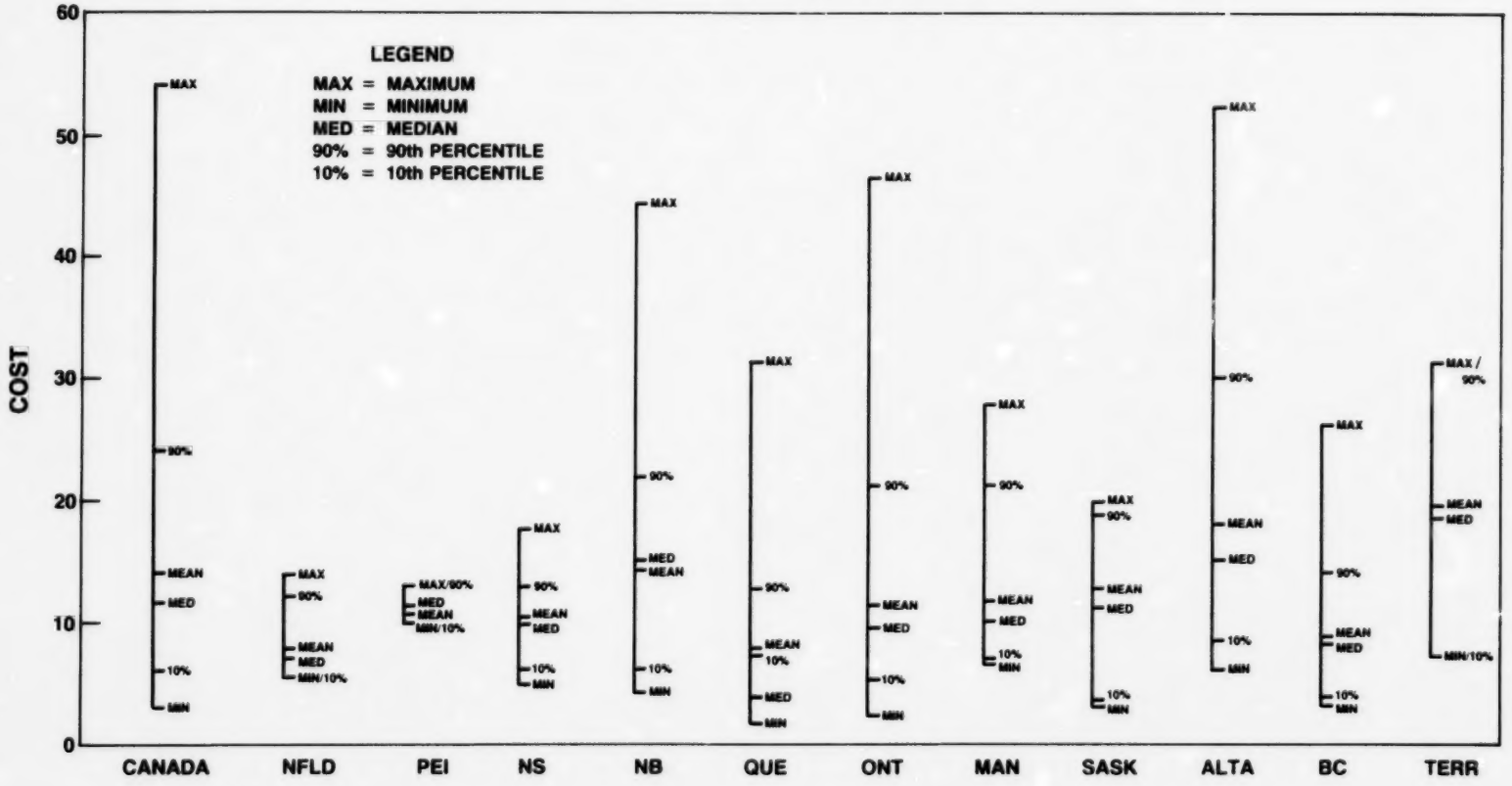

FIGURE 2

TOTAL PRICE ($) TO RESIDENTIAL WATER USERS FOR 10 CUBIC METRES PER MONTH OF WATER SUPPLIED, BY POPULATION SIZE GROUP

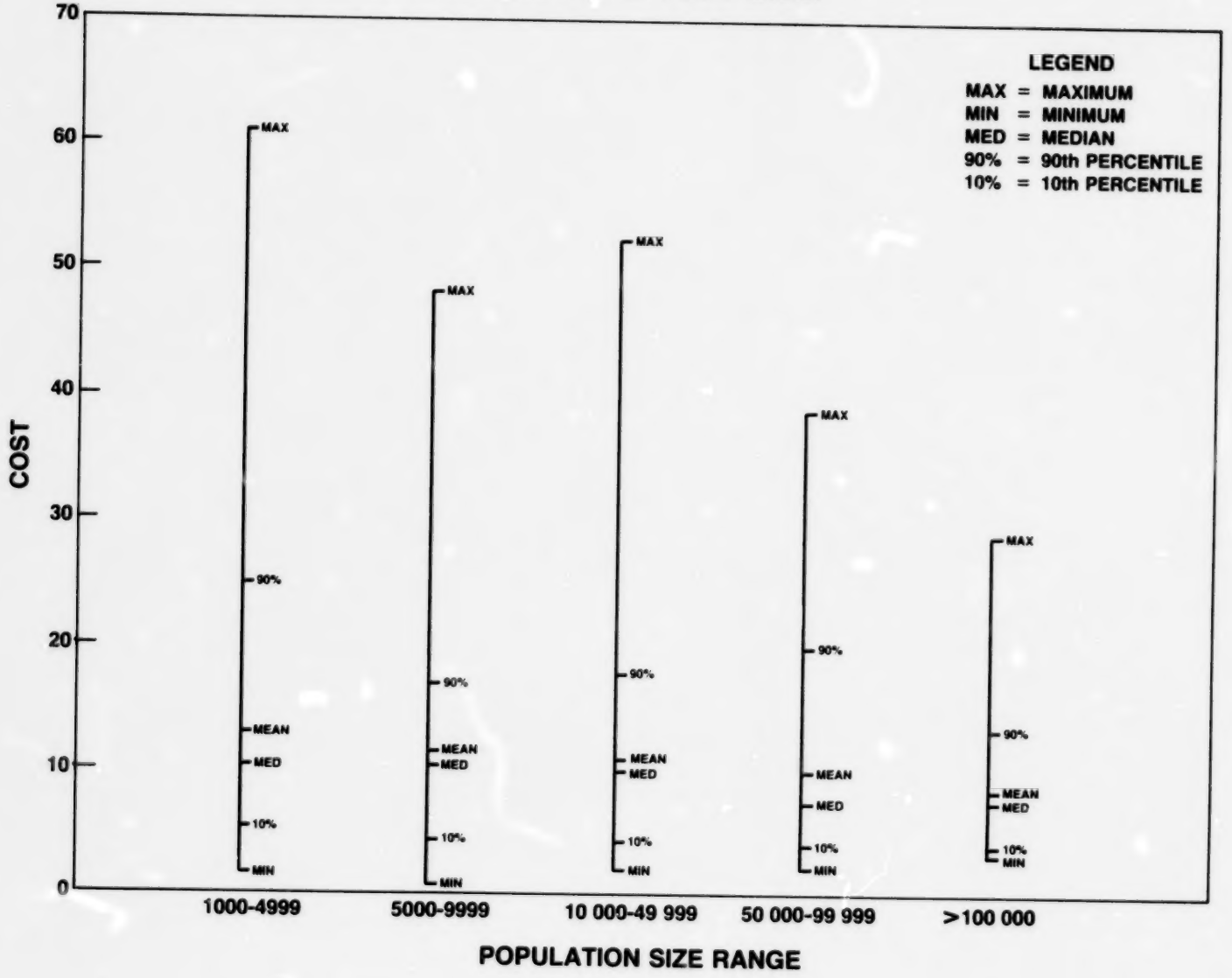

FIGURE 3

TOTAL PRICE ($) TO RESIDENTIAL WATER USERS FOR 35 CUBIC METRES PER MONTH OF WATER SUPPLIED, BY PROVINCE

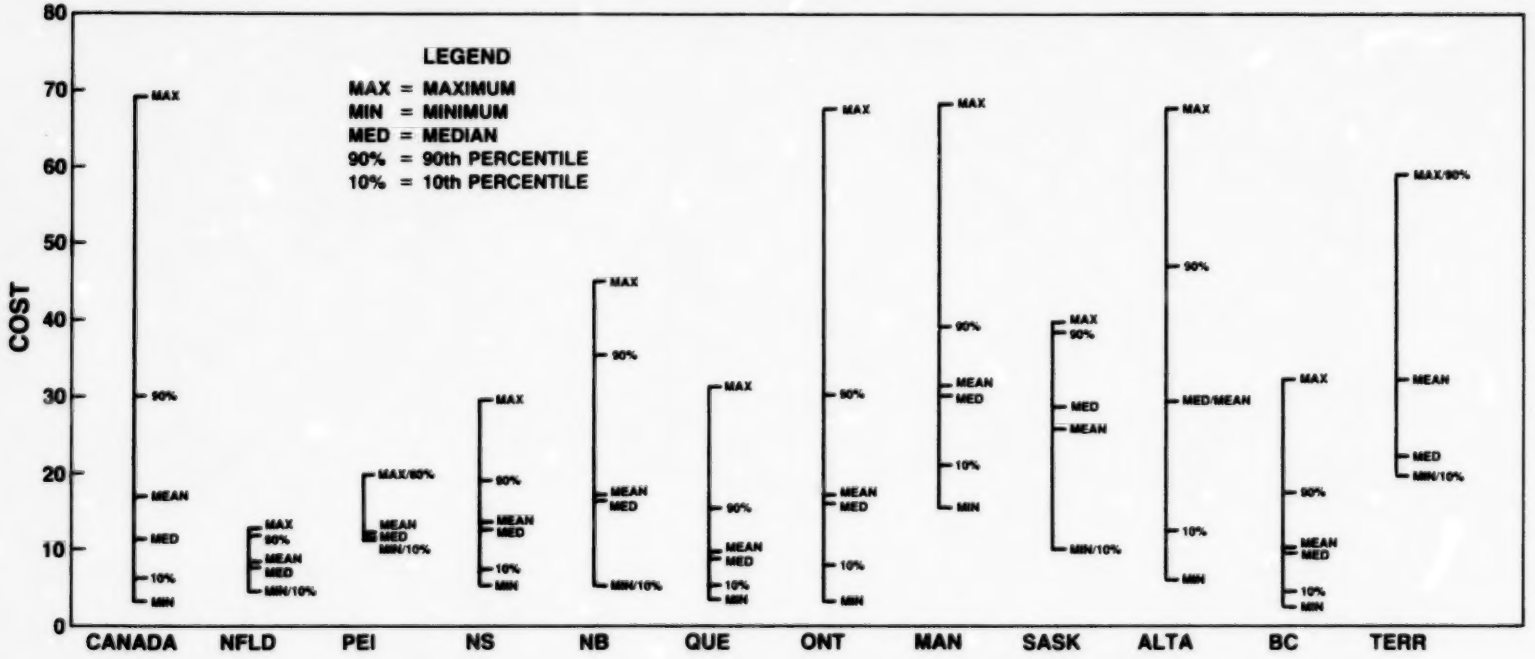

FIGURE 4

TOTAL PRICE ($) TO RESIDENTIAL WATER USERS
FOR 35 CUBIC METRES PER MONTH OF WATER SUPPLIED,
BY POPULATION SIZE GROUP

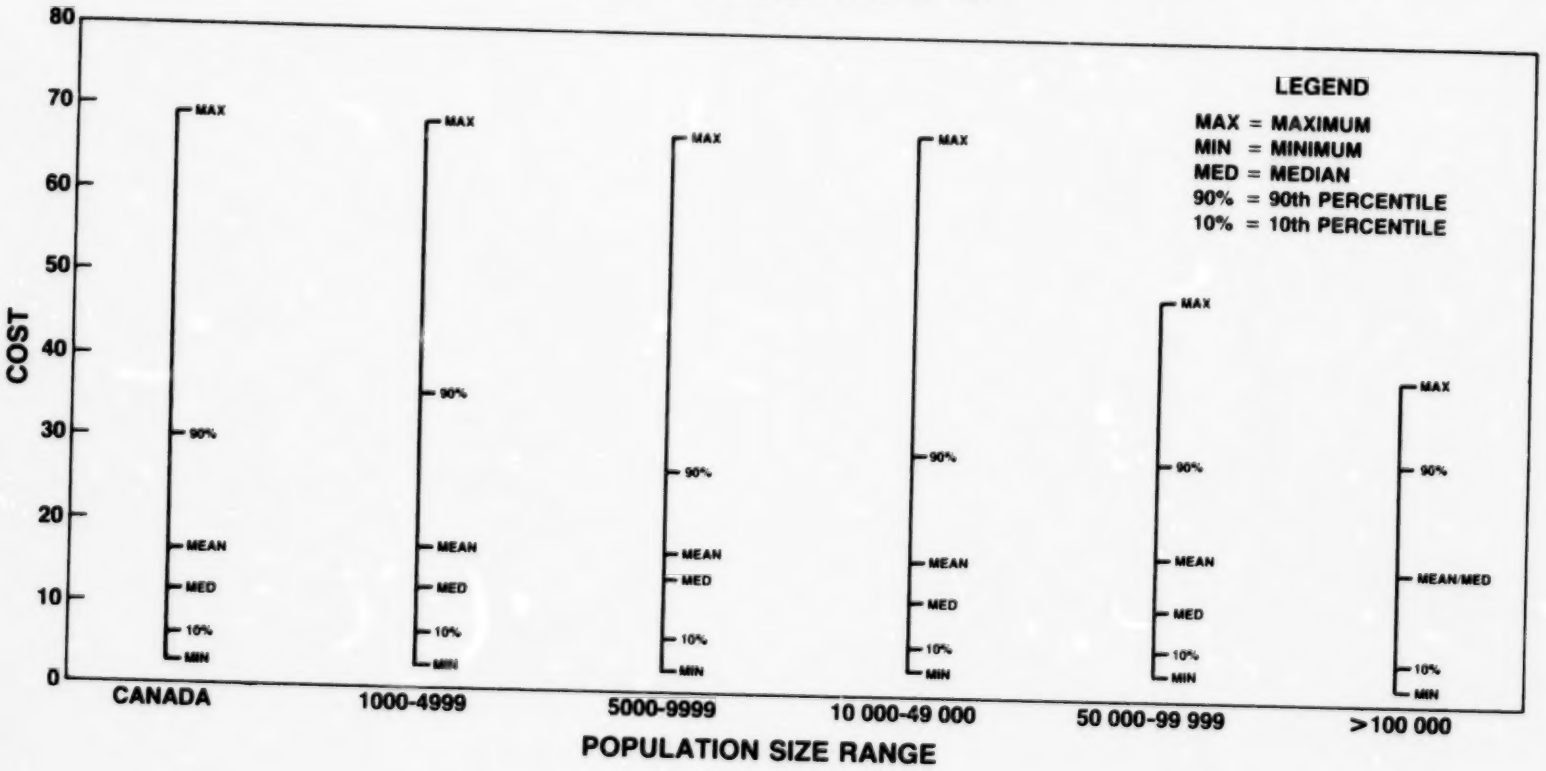

FIGURE 5

TOTAL PRICE ($) TO COMMERCIAL WATER USERS FOR 50 CUBIC METRES PER MONTH OF WATER SUPPLIED, BY PROVINCE

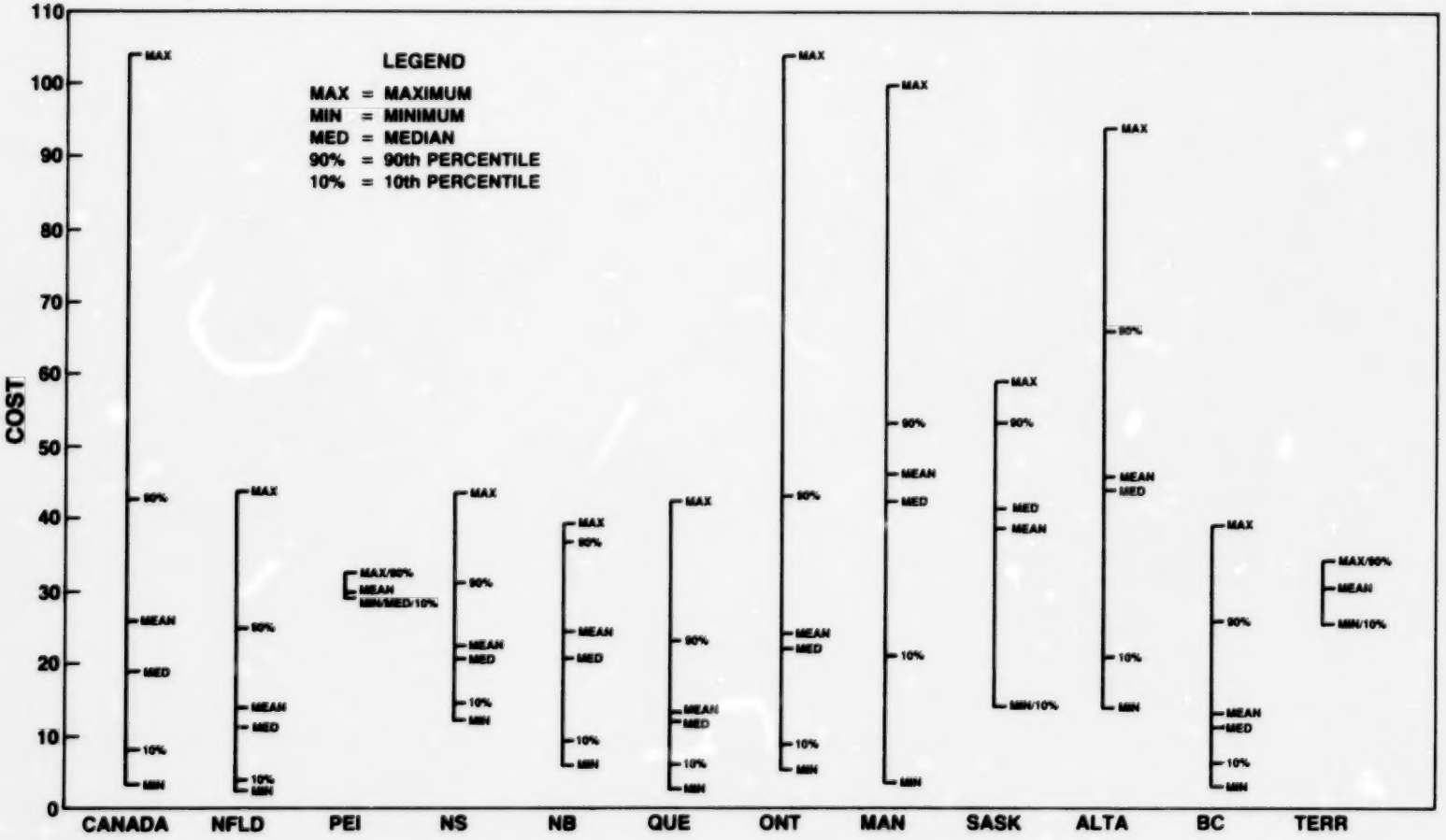

FIGURE 6

TOTAL PRICE ($) TO COMMERCIAL WATER USERS
FOR 50 CUBIC METRES PER MONTH OF WATER SUPPLIED,
BY POPULATION SIZE GROUP